

# Terahertz Quantum Cascade Laser-Based Sensors for Hypersonic Flows (7274-050), Phase I

Completed Technology Project (2004 - 2004)



## Project Introduction

Ground test facilities are used by NASA to simulate the conditions present during flight at hypersonic velocities, to test thermal protection materials for existing spacecraft and develop new hypersonic aircraft. To ensure the accuracy and usefulness of ground test results, the state of the gas in the ground test facility must be known. Key components of the test gas, such as atomic oxygen and atomic nitrogen, can be monitored today using pulsed laser sources operating in the ultraviolet region of the spectrum. However, this measurement scheme is not fast enough to detect rapid fluctuations which may be present. Our innovation is a sensor based on compact, portable source of tunable laser radiation in the far-infrared (terahertz) region of the spectrum which can be used to measure the number density and velocity of atomic oxygen continuously during a ground test. During Phase I we will prove feasibility by showing that a laser with the required wavelength, tuning range, and linewidth can be constructed. During Phase II we will prove practicality by optimizing the properties of the laser, building a prototype sensor, demonstrating the detection of atomic oxygen, and delivering the sensor to an appropriate NASA test facility.

## Primary U.S. Work Locations and Key Partners



Terahertz Quantum Cascade Laser-Based Sensors for Hypersonic Flows (7274-050), Phase I

## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Organizational Responsibility	1
Project Management	2
Technology Areas	2

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Langley Research Center (LaRC)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

# Terahertz Quantum Cascade Laser-Based Sensors for Hypersonic Flows (7274-050), Phase I

Completed Technology Project (2004 - 2004)



Organizations Performing Work	Role	Type	Location
★ Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Physical Sciences, Inc.	Supporting Organization	Industry	Andover, Massachusetts

Primary U.S. Work Locations	
Massachusetts	Virginia

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Joel Hensley

## Technology Areas

**Primary:**

- TX09 Entry, Descent, and Landing
  - └ TX09.1 Aeroassist and Atmospheric Entry
    - └ TX09.1.2 Hypersonic Decelerators